

CLAIMS

1. A method of supplying, to an operation performing apparatus which performs a predetermined operation related to a circuit substrate, such as a printed wiring board, that is conveyed thereto by a substrate conveyor, at least one constituent element of the operation performing apparatus, the method being characterized by comprising the step of

causing an element carrier plate to hold said at least one constituent element, causing the substrate conveyor to convey the element carrier plate to the operation performing apparatus, and thereby supplying said at least one constituent element to the operation performing apparatus.

2. A method of, in an operation performing apparatus which performs a predetermined operation related to a circuit substrate, such as a printed wiring board, that is conveyed thereto by a substrate conveyor, and which has a function of automatically exchanging at least one first constituent element thereof with at least one second constituent element thereof, exchanging said at least one first constituent element with said at least one second constituent element, the method being characterized by comprising the step of

causing an element carrier plate to hold said at least one second constituent element, causing the substrate conveyor to convey the element carrier plate to the operation performing apparatus, and causing the operation performing apparatus to exchange automatically said at least one first constituent element thereof, with said at least one second constituent element held by the element carrier plate.

3. A method of supplying at least one suction nozzle to a component mounting apparatus which has a mounting head including at least one nozzle-holding portion which holds said at least one suction nozzle such that said at least one suction nozzle is detachable from said at least one nozzle-holding portion, and which uses said at least one suction nozzle to hold, by suction, at least one electronic-circuit component and mount said at least one electronic-circuit component on a circuit substrate that is conveyed by a substrate conveyor and is held by a substrate holding device, the method being characterized by comprising the step of

causing a nozzle carrier plate to hold said at least one suction nozzle, causing the substrate conveyor to convey the nozzle carrier plate to the component mounting apparatus, and causing said at least one nozzle-holding portion of the mounting head to hold said at least one suction nozzle held by the nozzle carrier plate.

4. A method of, in a component mounting apparatus which has a mounting head including at least one nozzle-holding portion that holds at least one first suction nozzle such that said at least one first suction nozzle is detachable from said at least one nozzle-holding portion, which uses said at least one first suction nozzle to hold, by suction, at least one electronic-circuit component and mount said at least one electronic-circuit component on a circuit substrate that is conveyed by a substrate conveyor and is held by a substrate holding device, and which can automatically exchange said at least one first suction nozzle held by said at least one nozzle-holding portion, with at least one first suction nozzle held by a nozzle stocker, exchanging said at least one first suction nozzle held by the nozzle stocker, the method being characterized by comprising the step of

causing a plurality of nozzle-holding portions of a nozzle carrier plate to hold a plurality of second suction nozzles, respectively, causing the substrate conveyor to convey the nozzle carrier plate to the component mounting apparatus, and causing said at least one nozzle-holding portion of the mounting head to exchange automatically said at least one first suction nozzle held by the nozzle stocker, with at least one of the second suction nozzles held by the nozzle carrier plate.

5. The method according to claim 4, wherein a plurality of said component mounting apparatuses are arranged to constitute a component-mounting-apparatus line, and wherein the substrate conveyor is caused to convey the nozzle carrier plate to an arbitrary one of the component mounting apparatuses, and said at least one first suction nozzle held by the nozzle stocker of the arbitrary component mounting apparatus is automatically exchanged with said at least one second suction nozzle held by the nozzle carrier plate.

6. The method according to claim 5, wherein the plurality of

component mounting apparatuses comprise a plurality of modules, respectively, which have respective identical constructions and which are arranged adjacent to each other to constitute the component-mounting-apparatus line, and wherein said at least first suction nozzle held by the nozzle stocker of an arbitrary one of the modules is automatically exchanged with said at least one second suction nozzle held by the nozzle carrier plate.

7. An operation performing apparatus including a substrate conveyor which conveys a circuit substrate, and an operation performing device which performs a predetermined operation related to the circuit substrate conveyed by the substrate conveyor, the apparatus being characterized by further comprising

an element carrier plate which includes at least one element-holding portion that can hold at least one constituent element of the apparatus, and which can be conveyed by the substrate conveyor, wherein the substrate conveyor is caused to convey the element carrier plate to the apparatus and thereby supply said at least one constituent element to the apparatus.

8. An operation performing apparatus including a substrate conveyor which conveys a circuit substrate, and an operation performing device which performs a predetermined operation related to the circuit substrate conveyed by the substrate conveyor, the apparatus being characterized by further comprising

an element stocker which includes at least one stocker-side element-holding portion that can hold at least one first constituent element of the apparatus;

an element carrier plate which includes at least one plate-side element-holding portion that can hold at least one second constituent element of the apparatus, and which can be conveyed by the substrate conveyor; and

an exchanging device which exchanges said at least one first constituent element held by the element stocker, with said at least one second constituent element held by the element carrier plate conveyed by the substrate conveyor.

9. The operation performing apparatus according to claim 8, wherein each one of said at least one first constituent element and said at least one second constituent element has an identification-code recording portion where an identification code which identifies said each one constituent element from an other of said at least one first constituent element and said at least one second constituent element is recorded, wherein the apparatus further comprises a reading device which reads the respective identification codes from the respective identification-code recording portions of said at least one first constituent element and said at least one second constituent element, and wherein the exchanging device exchanges, based on the respective identification codes read by the reading device, said at least one first constituent element held by the element stocker, with said at least one second constituent element held by the element carrier plate.

10. The operation performing apparatus according to claim 9, further comprising an element-code memory in which the respective identification codes of said at least one first constituent element held by the element stocker and said at least one second constituent element held by the element carrier plate are stored, wherein the exchanging device exchanges, based on the respective identification codes stored in the element-code memory and the respective identification codes read by the reading device, said at least one first constituent element held by the element stocker, with said at least one second constituent element held by the element carrier plate.

11. A component mounting apparatus, characterized by comprising

a substrate conveyor which conveys a circuit substrate;

a substrate holding device which holds the circuit substrate conveyed by the substrate conveyor;

a mounting head which includes at least one head-side nozzle-holding portion that holds at least one first suction nozzle such that said at least one first suction nozzle is exchangeable, and which uses said at least one first suction nozzle to hold, by suction, at least one electronic-circuit component and mount said at least one electronic-circuit component

on the circuit substrate held by the substrate holding device;

a moving device which moves at least one of the mounting head and the substrate holding device relative to an other of the mounting head and the substrate holding device;

a nozzle carrier plate which can be conveyed by the substrate conveyor and can be held by the substrate holding device, and which includes at least one plate-side nozzle-holding portion that holds at least one second suction nozzle; and

a nozzle-receiving control device which controls the moving device so that said at least one head-side nozzle-holding portion of the mounting head holds said at least one second suction nozzle held by the nozzle carrier plate held by the substrate holding device.

12. A component mounting apparatus, characterized by comprising

a substrate conveyor which conveys a circuit substrate;

a substrate holding device which holds the circuit substrate conveyed by the substrate conveyor;

a mounting head which includes at least one head-side nozzle-holding portion that holds at least one first suction nozzle such that said at least one first suction nozzle is exchangeable, and which uses said at least one first suction nozzle to hold, by suction, at least one electronic-circuit component and mount said at least one electronic-circuit component on the circuit substrate held by the substrate holding device;

a moving device which moves at least one of the mounting head and the substrate holding device relative to an other of the mounting head and the substrate holding device;

a nozzle stocker which includes at least one stocker-side nozzle-holding portion that holds at least one first suction nozzle that is exchanged with said at least one first suction nozzle held by said at least one head-side nozzle-holding portion of the mounting head;

a nozzle carrier plate which can be conveyed by the substrate conveyor and can be held by the substrate holding device, and which includes at least one plate-side nozzle-holding portion that holds at least one second suction nozzle; and

a nozzle-exchange control device which controls the moving

device so that said at least one head-side nozzle-holding portion of the mounting head exchanges said at least one first suction nozzle held by the nozzle stocker, with said at least one second suction nozzle held by the nozzle carrier plate held by the substrate holding device.

13. The component mounting apparatus according to claim 11 or claim 12, wherein the mounting head includes

a rotatable body which is rotatable about an axis line thereof,

and

a plurality of said head-side nozzle-holding portions which are held by respective portions of the rotatable body that are located on a circle whose center is located on the axis line of the rotatable body, and which include respective end portions that hold the respective first suction nozzles such that each of the respective first suction nozzles is detachable from a corresponding one of the head-side nozzle-holding portions.

14. The component mounting apparatus according to any of claims 11 through 13, wherein the nozzle carrier plate has a plurality of fiducial marks whose images can be taken by an image taking device, wherein the apparatus further comprises a mark-image taking device which takes the respective images of the fiducial marks, and wherein the nozzle-receiving control device or the nozzle-exchange control device controls the moving device, based on results of processing of the images taken by the mark-image taking device.